III. On the Anomalous Phenomenon of the Apparent Projection of a Fixed Star on the Disk of the Moon after Apparent Immersion. By G. W. Hearn, Esq. Communicated by T. Galloway, Esq.

The author attempts to account for the anomalous phenomenon of the projection of a star on the disk of the moon before its immersion by the theory of the aberration of light. He supposes, in illustration of his theory, a screen to be placed across the *actual* direction of a ray of light proceeding from a star along the tube of a telescope; then, though this screen might not intercept the apparent path of the ray, yet the star would certainly disappear. If, on the contrary, the screen should intercept the apparent path of the ray, and not the real path, the star would not disappear, but would appear to be projected on the screen. He imagines that the moon in the heavens is such a screen, and that by the composition of the *secular* aberration of the light of a star (by which is meant the aberration arising from the star's proper motion), with the annual aberration computed according to the usual rules, most of the anomalous phenomena of occultation may be accounted for.

He takes as examples of the application of his theory the occultations of 119 *Tauri* and 120 *Tauri*, as observed by Sir James South and Mr. F. Simms, on December 31, 1831. By supposing in the case of the first star, its proper motion, resolved perpendicularly to the line joining the star and sun, and then parallel to the ecliptic, to be equal and in the same direction as the earth's motion in its orbit, or the absolute aberration to be nothing; and, in the case of the second star, this same resolved proper motion to be thrice the earth's motion in its orbit, and in the contrary direction, he thinks he can explain the fact of the instantaneous disappearance of the first at the moon's border, while the second was observed to disappear after being fairly within the illuminated part of the moon.

The author next discusses the case of the occultation of a planet by the moon, and takes, as an instance, the immersion of *Jupiter* and his satellites, behind the moon's dark limb, alleged to have been seen by Mr. Cornfield, at Northampton, on August 23, 1824. He then gives a general formula for finding the secular aberration deduced from the theory.

The author then proceeds to consider the indirect effect of the difference of atmospheric refraction of the light from the moon and stars in the production of the phenomenon in question, and states his views as follows:

"Admitting that light is propagated with the same velocity from each of the fixed stars, still their proper motions, combined with the probable motion of our own system and that of the earth in its orbit, must cause the relative velocities of light from the various fixed stars impinging on our atmosphere to be different, and this difference of relative velocity must produce a difference of refraction, however small that difference may be."

He lastly proceeds to shew how in certain cases this difference of refraction, though very small, may produce a very sensible effect

on the time between apparent immersion and disappearance, and investigates a mathematical formula, in which the supposed direct and indirect effects of aberration are combined, for determining the secular aberration of the star, and the amount of the difference of refraction for the moon and star.

IV. On the Longitude of the Honourable East India Company's Observatory at Madras. By T. G. Taylor, Esq.

The want of an accurate determination of the Longitude of the Madras Observatory has been greatly felt, both in an astronomical and a geographical point of view. In the former case, any error in the value assumed in the comparison of the places of the moon and planets with the tables, necessarily leads to seriously mischievous results; and in the latter, the triangles in the great trigonometrical survey of India depend for their zero upon the meridian passing through the Observatory; — the inquiry must therefore be considered one of singular importance. Mr. Goldingham, the predecessor of Mr. Taylor, had determined the longitude from no less than 230 observations of the eclipses of *Jupiter's* first and second satellite, and, before a result derived from so large a number of observations could be safely disputed, it seemed desirable to meet the inquiry with at least something like a corresponding number of observations.

The observations of moon-culminating stars were begun in 1831, on the erection of the present five-feet transit instrument, and the longitude, resulting from the observations of the first year as determined from the corresponding observations at Greenwich and Cambridge, was $5^h\ 21^m\ 3^s{\cdot}7$ or about 5^s less than the value assigned by Mr. Goldingham. At that time Mr. Taylor was not inclined to give to results obtained from moon-culminating stars that degree of credit which later experience has shewn them to deserve, from considerations connected with the probably varying error of the observations of the moon's limbs, but, as far as the present observations go, it appears that this error must be confined within narrow limits, since the semi-diameter of the moon, as measured at Madras, does not differ above half a second of space from that observed at Greenwich, Cambridge, Edinburgh, and Hamburg. Mr. Riddle, at the suggestion of Mr. Baily, undertook the reduction of the observations of the corresponding moon-culminating stars for the years 1834–1837, and the results are given in the twelfth volume of the Society's *Memoirs*.

The formula employed by him is precisely the same as that which has been used by Mr. Taylor, both in the previous as well as the present results; but there are one or two circumstances in which the treatment of the observations differs. In cases in which the full moon has happened in the interval between the moon's transiting the meridian of the Madras and the Western Observatory, it has sometimes happened that the first limb of the moon has been observed at Madras, and the second limb at the Western